REMARKS

Examiner Su Kim is thanked for the thorough examination and search of the subject Patent Application. Claims 8, 24, 26, 35, 38, 40, 43, 45-47, 54, 58, and 59 have been amended and Claims 13, 25, 36, 44, 48-53, and 57 have been canceled.

All Claims are believed to be in condition for Allowance, and that is so requested.

Examiner Kim is thanked for finding allowable subject matter in claims 13, 38, 45, 50, and 57. Claim 8 has been amended to include the allowable material in claim 13. Claim 24 has been amended to include the allowable material in claim 57 and also the subject matter in canceled claim 53. Claims 35 and 40 have been amended to include the subject matter of canceled dependent claims 36 and 44, respectively. Claim 40 has been amended to claim the second metal layer comprises hafnium nitride.

Reconsideration of the rejection under 35 U.S.C. 102 of Claims 8, 9, 14, 24, 26, 27, 35, 36, 37, 40, 41, 42, 48, 49, 50, 53, and 58 as being anticipated by Haukka et al is requested in view of amended Claims 8, 24, 26, 35, 38, 40, 43, 45-47, 54, 58, and 59 and in accordance with the following remarks.

Claim 8 has been amended to include the allowable subject matter of claim 13; that is, adjusting the work function of the gate electrodes by adjusting the atomic ratio of nitrogen and hafnium. It is believed that amended claim 8 is not anticipated by Haukka et al.

Claim 24 has been amended to include the allowable subject matter in claim 57 and to include the material in claim 53 so as to differentiate claim 24 from claim 8. It is believed that amended Claim 24 is not anticipated by Haukka et al.

Claim 35 has been amended to include the hafnium nitride deposition conditions claimed in claim 36. It is not agreed that Haukka et al teach depositing hafnium nitride by flowing nitrogen and argon atoms into a chamber simultaneously (office action, page 3, second paragraph). Col. 6, line 14 and the surrounding lines discusses the ALD deposition process. Haukka et al teaches that the layer is deposited in a series of material pulses. The material of the layer is deposited during each pulsing cycle. The reaction chamber is purged by the flow of nitrogen and argon gas "between material pulses to remove surplus gaseous reactants and reaction byproducts from the chamber." (col. 6, lines 13-16) Thus, the nitrogen and argon gas flow taught by Haukka et al is for the purpose of purging the chamber, not for the purpose of reacting with a hafnium target to effect deposition of the hafnium nitride layer as claimed in amended claim 35. Haukka et al do not teach depositing a hafnium nitride layer "comprises flowing Nitrogen and Argon atoms into a chamber simultaneously wherein said chamber contains said substrate and a hafnium target" as claimed in amended claim 35.

Claim 40 has been amended to claim the hafnium nitride deposition conditions claimed in claim 44. As discussed above, Haukka et al do not teach depositing a hafnium nitride layer "comprises flowing Nitrogen and Argon atoms into a chamber simultaneously wherein said chamber contains said substrate and a hafnium target" as claimed in amended claim 40.

The Examiner states in the third paragraph on page 3 of the office action that Haukka et al discloses impurity doping into the hafnium nitride layer to tune the work function of the gate electrodes. It is not agreed that this is taught by Haukka et al. In col. 8, lines 52-62, Haukka et al teaches *removing* impurities such as residual halides and/or carbon or volatile impurities. Applicants claim that impurities are *added into* the hafnium nitride layer – "impurity doping into said hafnium nitride layer." (Claims 14, 39, and 58) Thus, these claims are not anticipated by Haukka et al.

Reconsideration of the rejection under 35 U.S.C. 102 of Claims 8, 9, 14, 24, 26, 27, 35, 36, 37, 40, 41, 42, 48, 49, 50, 53, and 58 as being anticipated by Haukka et al is requested in view of amended Claims 8, 24, 26, 35, 38, 40, 43, 45-47, 54, 58, and 59 and in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103(a) of Claims 10, 15, 52, 54, and 59 as being unpatentable over Haukka et al is requested in view of amended claims 8 and 24 and in accordance with the following remarks.

As discussed above, it is not agreed that Haukka et al teaches depositing hafnium nitride by flowing nitrogen and argon atoms into a chamber simultaneously. Col. 6, line 14 and the surrounding lines discusses the ALD deposition process. Haukka et al teaches that the layer is deposited in a series of material pulses. The material of the layer is deposited during each pulsing cycle. The reaction chamber is purged by the flow of nitrogen and argon gas "between

material pulses to remove surplus gaseous reactants and reaction byproducts from the chamber." (col. 6, lines 13-16) Thus, the nitrogen and argon gas flow taught by Haukka et al is for the purpose of purging the chamber, not for the purpose of reacting with a hafnium target to effect deposition of the hafnium nitride layer as claimed in claim 9 and amended claim 24. Haukka et al does not teach or suggest depositing a hafnium nitride layer "comprises flowing Nitrogen and Argon atoms into a chamber simultaneously wherein said chamber contains said substrate and a hafnium target" as claimed in claim 9 and amended claim 24.

Claims 10 and 54 claim the optimum flow rates of nitrogen and argon for the deposition of the hafnium nitride layer. Since Haukka et al does not teach or suggest using these gases to deposit hafnium nitride, the claimed flow rates would not be obvious in view of Haukka et al.

It is agreed that while Haukka et al teaches annealing of the hafnium nitride layer, Haukka et al does not teach or suggest the particular annealing conditions, claimed in claims 15 and 59, found by Applicants to be optimal for their invention. Furthermore, as stated by the Examiner on the bottom of page 8 of the office action, Haukka et al does not teach or suggest adjusting the work function of the gate electrodes by adjusting the atomic ratio of nitrogen and hafnium as claimed in amended claims 8 and 24 upon which claims 15 and 59 respectively depend.

Reconsideration of the rejection under 35 U.S.C. 103(a) of Claims 10, 15, 52, 54, and 59 as being unpatentable over Haukka et al is requested in view of amended claims 8 and 24 and in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103(a) of Claims 11 and 55 as being unpatentable over Haukka et al in view of Metzner et al is requested in view of amended claims 8 and 24 and in accordance with the following remarks.

As discussed above, claims 8 and 24 have been amended to include the allowable subject matter from their dependent claims 13 and 57, respectively. Claims 11 and 55 provide further detail about the amended claimed invention which is not taught or suggested by the combination of references.

Reconsideration of the rejection under 35 U.S.C. 103(a) of Claims 11 and 55 as being unpatentable over Haukka et al in view of Metzner et al is requested in view of amended claims 8 and 24 and in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103(a) of Claims 12 and 56 as being unpatentable over Haukka et al in view of Chen is requested in view of amended claims 8 and 24 and in accordance with the following remarks.

As discussed above, claims 8 and 24 have been amended to include the allowable subject matter from their dependent claims 13 and 57, respectively. Claims 12 and 56 provide further detail about the amended claimed invention which is not taught or suggested by the combination of references.

Reconsideration of the rejection under 35 U.S.C. 103(a) of Claims 12 and 56 as being unpatentable over Haukka et al in view of Chen is requested in view of amended claims 8 and 24 and in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103(a) of Claims 25, 43, 44, 46, and 47 as being unpatentable over Haukka et al in view of Li is requested in view of amended claims 24 and 40 and in accordance with the following remarks.

Claim 24 has been amended to claim the first metal layer is hafnium nitride and claim 25 has been canceled, so the rejection is moot for these claims.

Claim 40 has been amended to claim that the second metal layer is hafnium nitride from canceled claim 43. It is agreed that Li suggests that the gate electrode can be hafnium nitride. However, neither Haukka et al nor Li teaches or suggests the deposition method of claim 44, now incorporated into claim amended 40. As discussed above, Haukka et a does not teach or suggest depositing a hafnium nitride layer "comprises flowing Nitrogen and Argon atoms into a chamber simultaneously wherein said chamber contains said substrate and a hafnium target" as claimed in amended claim 40.

With regard to claim 46, as discussed above, it is not agreed that impurity doping into the hafnium nitride layer to tune the work-function of the gate electrodes is taught or suggested by the combination of references. In col. 8, lines 52-62, Haukka et al teaches *removing* impurities

such as residual halides and/or carbon or volatile impurities. Applicants claim that impurities are *added into* the hafnium nitride layer – "impurity doping into said hafnium nitride layer."

With regard to claim 47, it is agreed that while Haukka et al teaches annealing of the hafnium nitride layer, Haukka et al does not teach or suggest the particular annealing conditions, claimed in claim 47, found by Applicants to be optimal for their invention. Claim 47 provides further detail about the amended claimed invention which is not taught or suggested by the combination of references.

Reconsideration of the rejection under 35 U.S.C. 103(a) of Claims 25, 43, 44, 46, and 47 as being unpatentable over Haukka et al in view of Li et al is requested in view of amended claims 8 and 24 and in accordance with the remarks above.

Allowance of all Claims is requested.

It is requested that should Examiner Kim not find that the Claims are now Allowable that the Examiner call the undersigned at 765 4530866 to overcome any problems preventing allowance.

Respectfully submitted,

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